Quantum Physics

A generalized Grothendieck inequality and entanglement in XOR games

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Suppose Alice and Bob make local two-outcome measurements on a shared entangled state. For any d, we show that there are correlations that can only be reproduced if the local dimension is at least d. This resolves a conjecture of Brunner et al. Phys. Rev. Lett. 100, 210503 (2008) and establishes that the amount of entanglement required to maximally violate a Bell inequality must depend on the number of measurement settings, not just the number of measurement outcomes. We prove this result by establishing the first lower bounds on a new generalization of Grothendieck's constant.

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